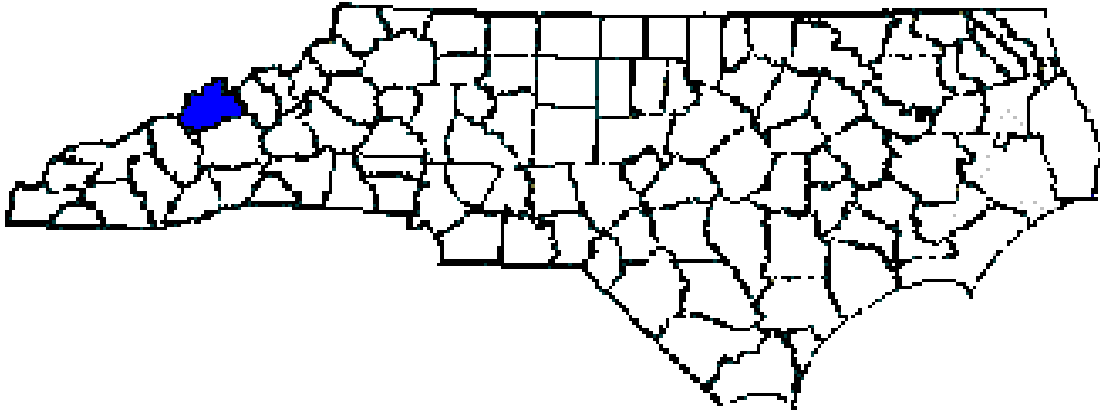


ANNUAL REPORT FOR 2015



Middle Fork Creek Site I Mitigation Site
Madison County
TIP No. R-2518A
COE Action ID: SAW-2007-2197-357/300
DWR #: 20071134



Prepared By:
Natural Environment Section & Roadside Environmental Unit
North Carolina Department of Transportation
November 2015

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SUMMARY

The following report summarizes the stream monitoring activities that have occurred during the Year 2015 at the Middle Fork Creek Site I Mitigation Site in Madison County. The North Carolina Department of Transportation (NCDOT) completed this project in October 2008 and water was turned in June 2009 (Sta. 10+00 to 12+00) and May 2011 (Sta. 12+00 to 12+40). This report provides the monitoring results for the sixth formal year of monitoring (Year 2015). The Year 2015 monitoring period was the sixth of five scheduled years of monitoring on the Middle Fork Creek Site I Mitigation Site (See Success Criteria Section 2.1).

Based on the overall conclusions of monitoring at the Middle Fork Creek Site I, it has met the required monitoring protocols for the sixth formal year of monitoring on the stream, except for, a bank failure along the left bank at longitudinal profile Station 343+00 (Cross Section #3, Repair Plans Sta. 14+20). Further remedial action will be needed. Stream repairs completed in June 2014 at Site I included constructing j-hooks, geolifts, rock vanes, boulder toe, grading work and removing some structures to stabilize the stream (see repair plans on pages 7 & 8). It has met the fourth formal year of monitoring on the planted vegetation. A supplemental planting took place in March 2015 after the stream repairs and herbicide applications were completed.

NCDOT will continue stream and vegetation monitoring at the Middle Fork Creek Site I Mitigation Site in 2016.

1.0 INTRODUCTION

1.1 Project Description

The following report summarizes the stream monitoring activities that have occurred during the Year 2015 at the Middle Fork Creek Site I Mitigation Site. Site I is located on US 19 in Madison County at Sta. 51+70 to 53+90 -L- Lt. (Figure 1). The Middle Fork Creek Site I was constructed to provide mitigation for stream impacts associated with Transportation Improvement Program (TIP) number R-2518A in Madison County.

The mitigation site provided approximately 787 linear feet of stream relocation/restoration. Construction was completed during October 2008 and water was turned in June 2009 (Sta. 10+00 to 12+00) and May 2011 (Sta. 12+00 to 12+40) by the NCDOT. The stream relocation involved excavation of a new floodplain and channel, installing several in-stream cross vane structures and planting the riparian buffer zone.

1.2 Purpose

In order for a mitigation site to be considered successful, the site must meet the success criteria. This report details the monitoring in 2015 at the Middle Fork Creek Site I Mitigation Site. Hydrologic monitoring was not required for this site.

1.3 Project History

October 2008	Construction Completed (Sta. 10+00 to 12+00)
March 2009	Site Planted (Type I only)
June 2009	Water Turned Into Stream (Sta. 10+00 to 12+00)
October 2009	As-Built Survey Completed (Sta. 10+00 to 12+00)
November 2010	Stream Channel Monitoring (Year 1)
May 2011	Construction Completed (Sta. 12+00 to 12+40)
November 2011	As-Built Survey Completed (Sta. 12+00 to 12+40)
November 2011	Stream Channel Monitoring (Year 2)
March 2012	Site Planted (Type I and II)
September 2012	Vegetation Monitoring (Year 1)
November 2012	Stream Channel Monitoring (Year 3)
March 2013	Bankfull Monitoring Gauge Installed
August 2013	Vegetation Monitoring (Year 2)
November 2013	Stream Channel Monitoring (Year 4)
June 2014	Herbicide Application on Japanese Knotweed
July 2014	Mowed Lespedeza Along West Buffer
July 2014	Herbicide Application on Japanese Knotweed
July 2014	Vegetation Monitoring (Year 3)
August 2014	Herbicide Application on Lespedeza Along West Buffer
November 2014	Stream Channel Monitoring (Year 5)
March 2015	Supplemental Planting

July 2015
November 2015

Vegetation Monitoring (Year 4)
Stream Channel Monitoring (Year 6)

1.4 Debit Ledger

The entire Middle Fork Creek Site I stream mitigation site was used for the R-2518A project to compensate for unavoidable stream impacts.



Figure 1. Vicinity Map

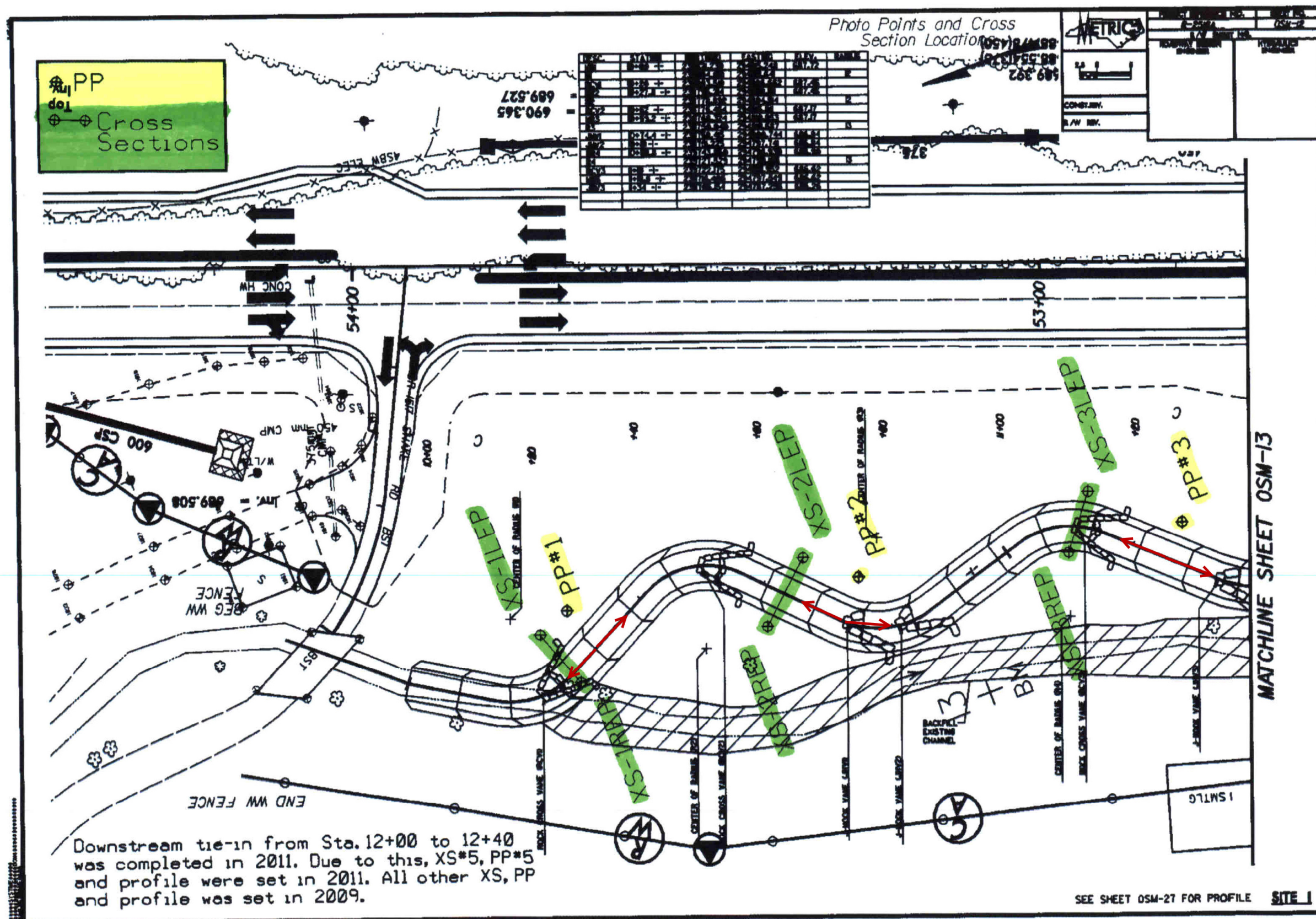


Figure 2. Site I Map

STREAMBANK REFORESTATION FOR SITE I



PROJECT REFERENCE NO.	SHEET NO.
R-2518A	RF-9
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

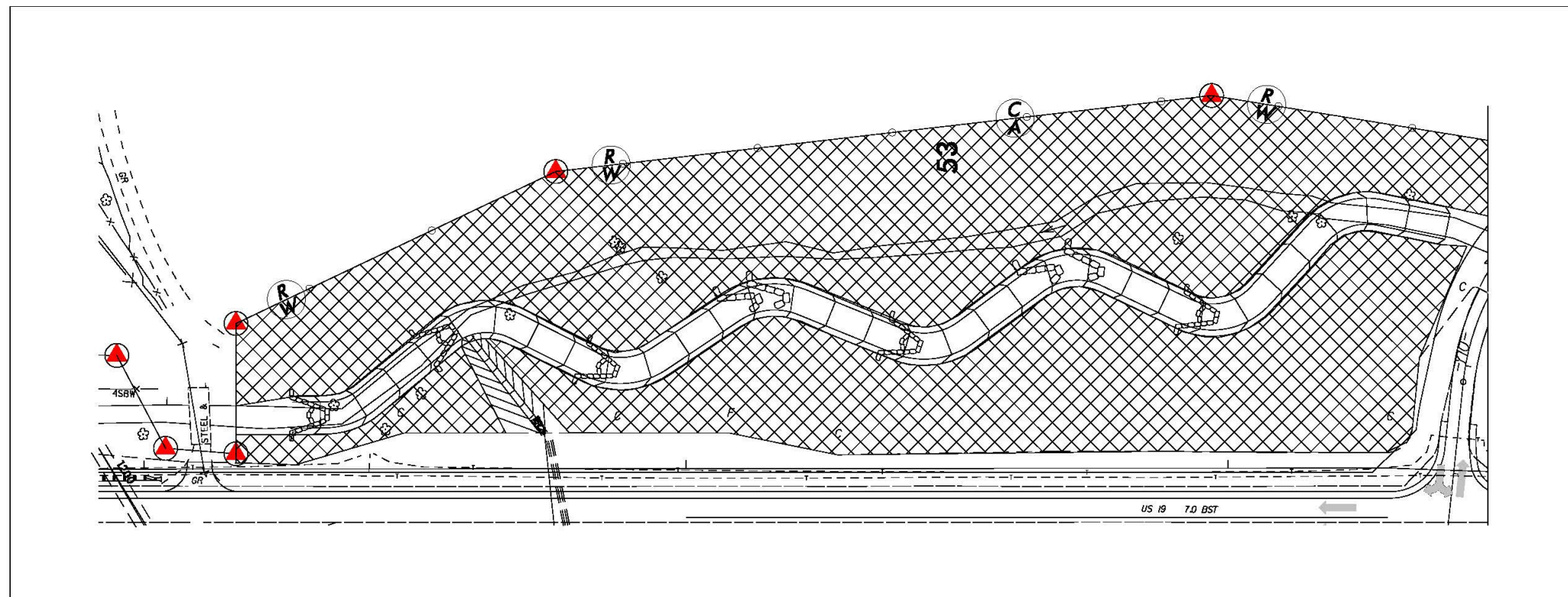


Figure 4. Site I Reforestation Map

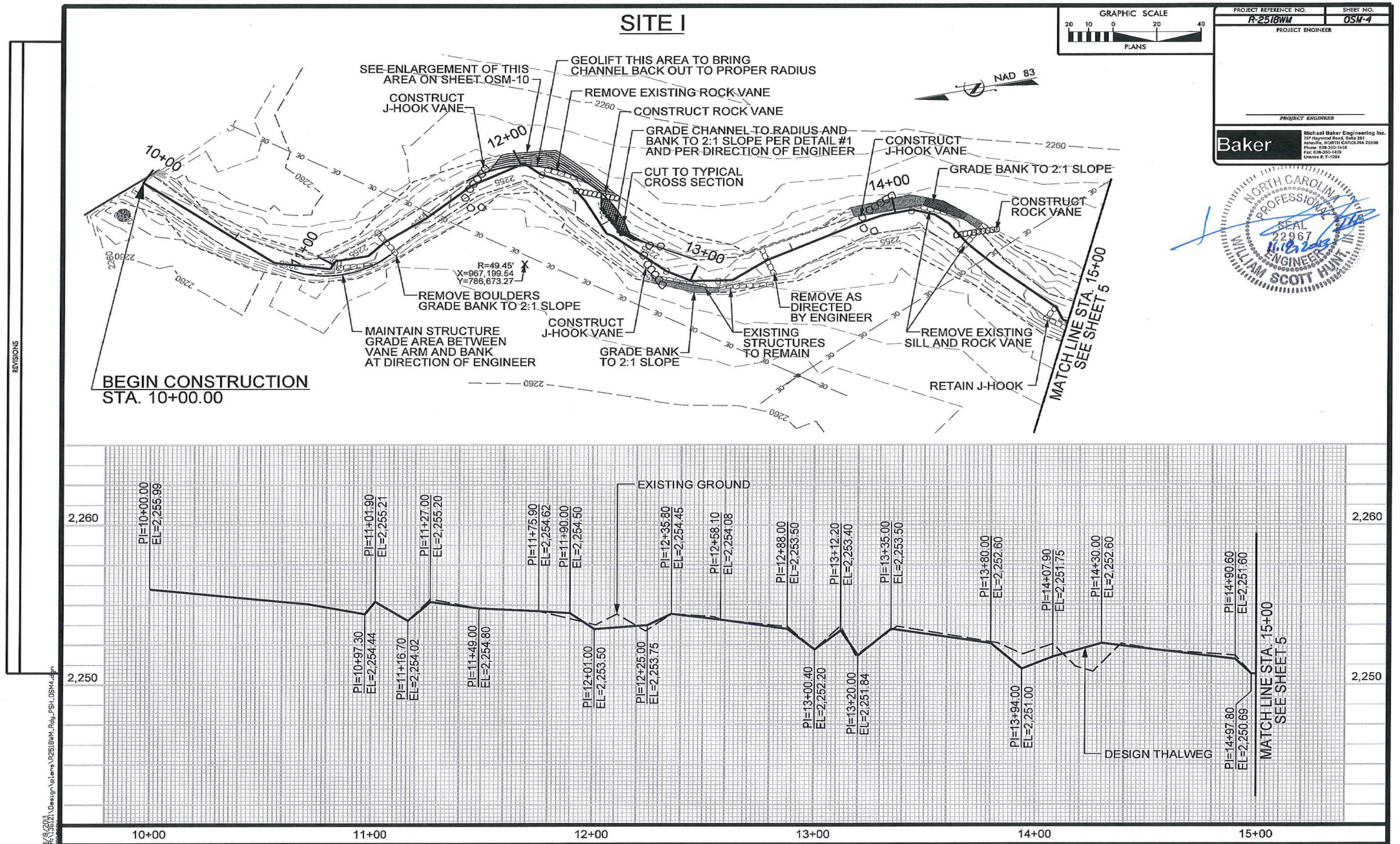


Figure 5. Site I Repair Plans

2.0 STREAM ASSESSMENT

2.1 Success Criteria

The permittee shall monitor the restoration and enhancement mitigation sites following the Level 1 protocols outlined in the "Stream Mitigation Guidelines," dated April 2003 with the following exceptions:

1. Pebble counts shall not be conducted.
2. Two cross sections shall be conducted for streams less than 500 linear feet and five (5) cross sections shall be conducted for streams greater than 500 linear feet.
3. Riparian success shall be by visual inspection of plant survival. Photos will be taken and comments noted on plant survival.

The permittee shall monitor the preservation sites by visual inspection. Photos will be taken and comments noted on plant survival. The monitoring shall be conducted annually for a minimum of five (5) years after final planting. The monitoring results shall be submitted to DWR in a final report within sixty (60) days after completing monitoring. After 5 years the NCDOT shall contact the DWR to schedule a site visit to "close out" the mitigation site.

2.2 Stream Description

2.2.1 Post-Construction Conditions

The stream relocation of the Middle Fork Creek Site I Mitigation Site involved excavation of a new floodplain and channel, installing several in-stream cross vane structures and planting the riparian buffer zone.

2.2.2 Monitoring Conditions

The objective of the Middle Fork Creek Site I stream restoration/relocation was to restore a B4c stream as identified in Rosgen's Applied River Morphology. A total of five cross sections (three in a riffle and two in a pool) were surveyed. For this report, only cross sections containing riffles were used in the comparison of channel morphology presented below in Table 1 (Site I).

Table 1. Abbreviated Morphological Summary (Middle Fork Creek Site I)

Variable	Proposed	Cross-Section #2 (Riffle)	Cross-Section #4 (Riffle)	Cross-Section #5 (Riffle)	Min. – Max Values (Riffle Sections Only)
		2015	2015	2015	2015
Drainage Area (mi ²)	7.08	7.08	7.08	7.08	7.08
Bankfull Cross Sectional Area (ft ²)	47.04	48.75	50.96	46.92	46.92 – 50.96
Maximum Bankfull Depth (ft.)	2.38 – 2.97	3.61	3.98	3	3 – 3.98
Width of the Floodprone Area (ft.)	40.05	37	35.4	45.3	35.4 – 45.3
Bankfull Mean Depth (ft.)	1.98	1.91	2.23	1.83	1.83 – 2.23
Width/Depth Ratio	12	13.36	10.26	14.04	10.26 – 14.04
Entrenchment Ratio	1.7	1.45	1.55	1.76	1.45 – 1.76
Bankfull Width (ft.)	23.8	25.52	22.88	25.7	22.88 – 25.7

* Riffle values are used for classification purposes, pool values are shown in Appendix A.

2.3 Results of the Stream Assessment

2.3.1 Site Data

The assessment included the survey of five cross sections and the longitudinal profile of the Middle Fork Creek Site I established by NCDOT after construction. The length of the profile along the Middle Fork Creek Site I was approximately 787 linear feet. Five cross sections were established during the as-built monitoring year. Cross section locations were subsequently based on the stationing of the longitudinal profile and are presented below. The location of the cross sections and longitudinal profile are shown in Appendix A.

Middle Fork Creek Site I Cross-Sections:

- ◆ Cross-Section #1: Middle Fork Creek Site I, Station 47+00, midpoint of pool
- ◆ Cross-Section #2: Middle Fork Creek Site I, Station 185+05, midpoint of riffle
- ◆ Cross-Section #3: Middle Fork Creek Site I, Station 343+00, midpoint of pool
- ◆ Cross-Section #4: Middle Fork Creek Site I, Station 493+00, midpoint of riffle
- ◆ Cross-Section #5: Middle Fork Creek Site I, Station 687+00, midpoint of riffle

Based on comparisons of the As-Built to the monitoring data, all of the cross sections appear stable with little or no active bank erosion, except for, Cross Section #3. Graphs of the cross sections are presented in Appendix A. Future survey data will vary depending on actual location of rod placement and alignment; however, this information should remain similar in appearance. The longitudinal profile showed that the channel bed was stable for the 2015 monitoring evaluation.

Stream repairs completed in June 2014 at Site I included constructing j-hooks, geolifts, rock vanes, boulder toe, grading work and removing some structures to stabilize the stream (see repair plans on pages 9 & 10). Cross Sections 3, 4, and 5 had to be reset due to the stream repairs, therefore, these cross sections were not overlaid with the previous year's data. (See Appendix A).

It was noted during the 2015 monitoring that the left bank at longitudinal profile Sta. 343+00 (Cross Section #3) has eroded as depicted in the graph for Cross Section #3. During the 2014 monitoring, it was noted that there was an undercut bank between two J-hooks at longitudinal profile Sta. 441+00 and some boulder toe protection had dropped from the bank into the stream at Sta. 550+00. Live staking was completed in March 2015 to help stabilize these areas. These areas remain the same with little to no change. NCDOT will investigate the unstable bank at Cross Section #3 to see what remedial action is needed. Pebble counts were not required per the permit conditions and therefore were not completed. Four bankfull events were documented by a surface water gauge at Site I during the 2013 and 2014 monitoring years.

3.0 VEGETATION: MIDDLE FORK CREEK SITE I

3.1 Description of Species

The following tree species were planted on the streambank:

Salix nigra, Black Willow

Cornus amomum, Silky Dogwood

The following tree species were planted in the buffer area:

Liriodendron tulipifera, Yellow Poplar

Platanus occidentalis, Sycamore

Fraxinus pennsylvanica, Green Ash

Quercus alba, White Oak

3.2 Results of Vegetation Monitoring

Streambank & Buffer Vegetation: The streambank reforestation was completed in March 2012. A supplemental planting took place in March 2015 after stream repairs and herbicide applications to lespedeza were completed. The Year 4 vegetation monitoring evaluation noted: Type I: Black Willow and Silky Dogwood and Type II: Sycamore, Green Ash, Tulip Poplar, and White Oak were surviving at the time of the monitoring evaluation. There was no Japanese Knotweed noted onsite in 2015.

3.3 Conclusions

NCDOT will continue to monitor the planted vegetation in 2016.

4.0 OVERALL CONCLUSIONS/RECOMMENDATIONS

The Middle Fork Creek Site I Mitigation Site has met the required monitoring protocols for the sixth formal year of monitoring on the stream and for the fourth formal year of monitoring on the planted vegetation.

NCDOT will investigate the unstable bank at Cross Section #3 to see what remedial action is needed and will continue monitoring the Middle Fork Creek Site I Mitigation Site in 2016.

5.0 REFERENCES

Stream Mitigation Plan, US Highway 19, R-2518A On-Site Mitigation
Madison County, North Carolina, August 2006.

Design Plans for R-2518A, US 19 from I-26 to 0.8 KM east of the Yancey Co.
Line, Stream Mitigation (Preservation, Enhancement, and Restoration),
HSMM.

North Carolina Department of Transportation (NCDOT), April 29, 2008. 404 and
401 Individual Permits for R-2518A and R-2518B (ACOE Permit No. 2007-
2197-357/300 and DWR Project No. 20071134, Individual Certification No.
3706).

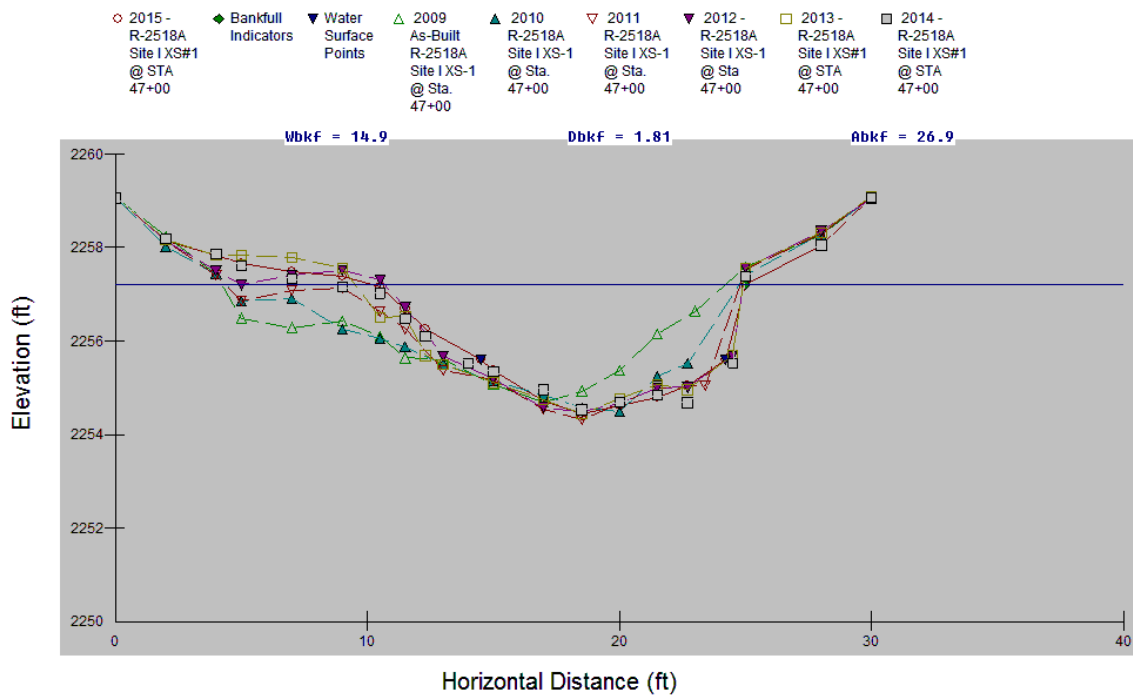
Rosgen, D.L, 1996. Applied River Morphology. Wildland Hydrology, Pagosa
Springs, Colorado.

US Army Corps of Engineers (USACE), 2003. Stream Mitigation Guidelines.
Prepared with cooperation from the US Environmental Protection Agency,
NC Wildlife Resources Commission, and the NC Division of Water
Resources.

APPENDIX A

CROSS SECTIONS AND LONGITUDINAL PROFILE

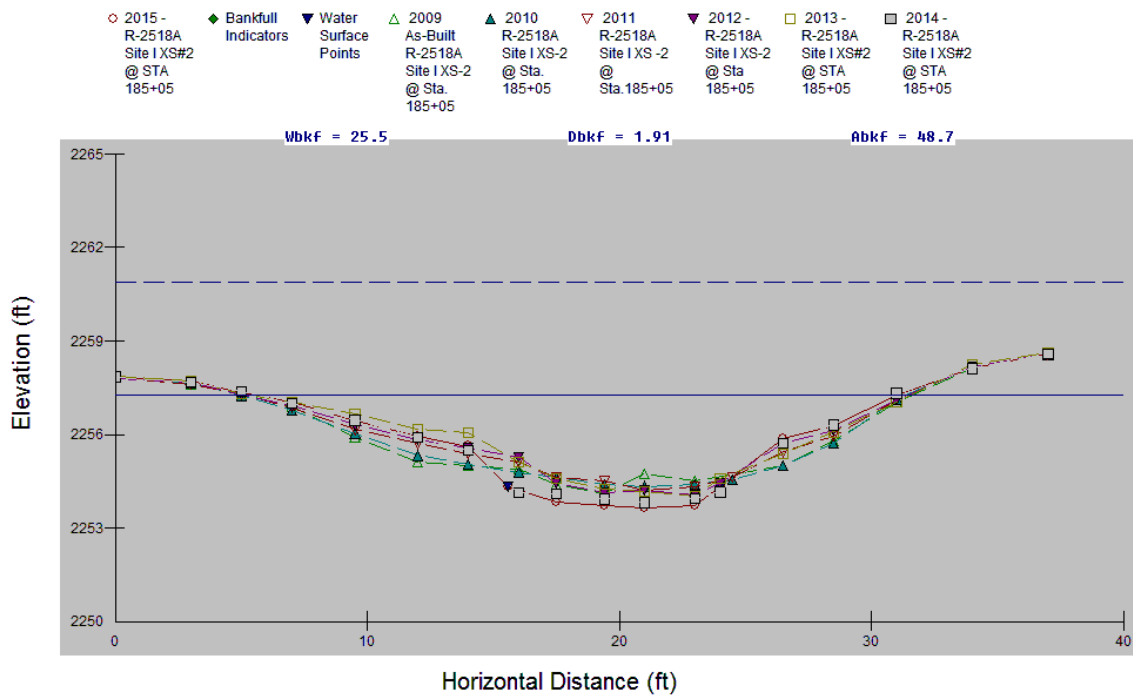
R-2518A Site I XS#1 @ STA 47+00



Site I: Cross-Section #1 (Pool) Abbreviated Morphological Summary						
	2010	2011	2012	2013	2014	2015
Bankfull Cross Sectional Area (ft ²)	34.89	42.04	33.97	34.54	31.17	26.95
Maximum Bankfull Depth (ft.)	2.93	2.89	3.07	3.11	2.86	2.78
Bankfull Mean Depth (ft.)	1.66	1.67	1.61	2.16	1.7	1.81
Bankfull Width (ft.)	20.97	25.14	21.16	15.99	18.36	14.89

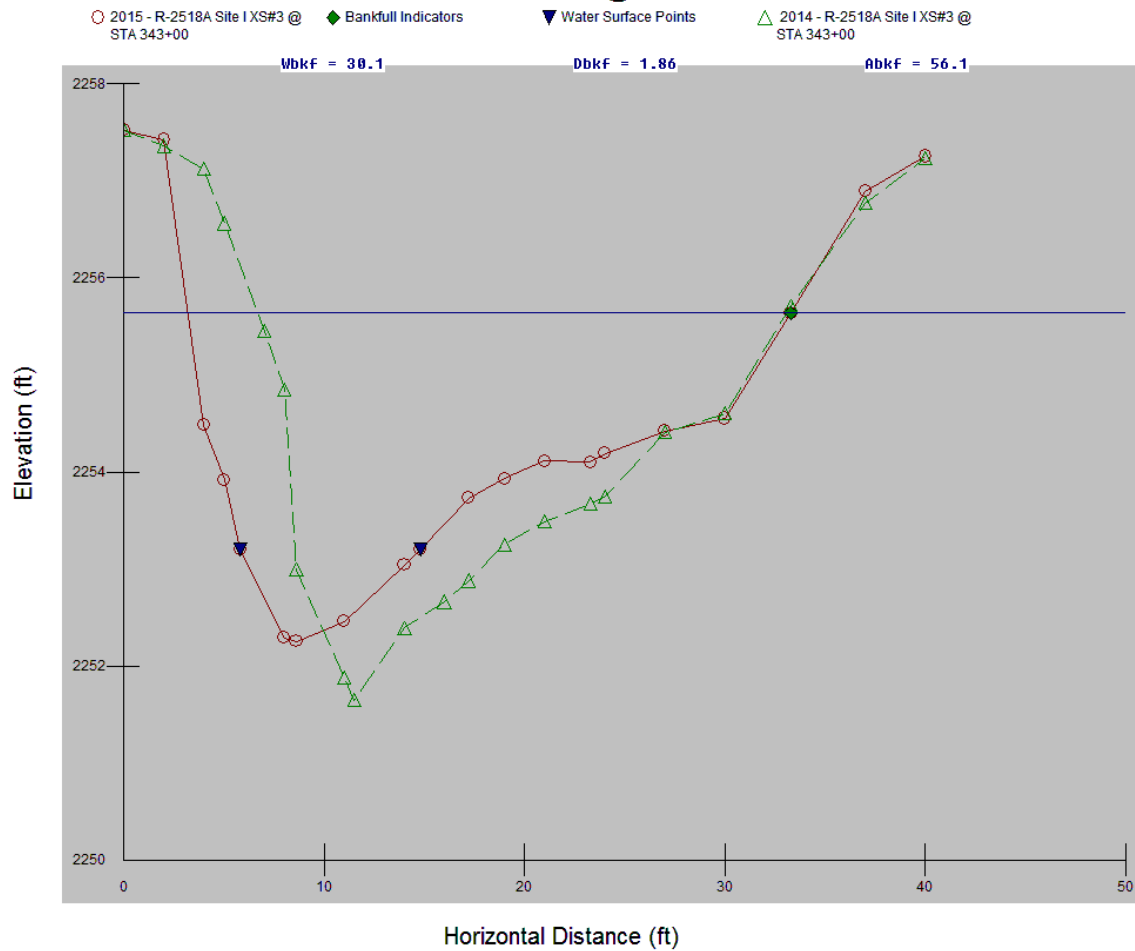
*According to the Rosgen Classification of Natural Rivers floodprone width, entrenchment ratio, and width depth ratio are not measured in pool, glide, or run features.

R-2518A Site I XS#2 @ STA 185+05



Site I: Cross-Section #2 (Riffle) Abbreviated Morphological Summary						
	2010	2011	2012	2013	2014	2015
Bankfull Cross Sectional Area (ft ²)	46.76	42.04	41.31	36.86	49.33	48.75
Maximum Bankfull Depth (ft.)	2.8	2.89	1.64	3.01	3.5	3.61
Width of the Floodprone Area (ft.)	37	37	37	37	37	37
Bankfull Mean Depth (ft.)	1.83	1.67	1.64	1.54	1.92	1.91
Width/Depth Ratio	13.96	15.05	15.35	15.58	13.38	13.36
Entrenchment Ratio	1.45	1.47	1.47	1.54	1.44	1.45
Bankfull Width (ft.)	25.54	25.14	25.17	24	25.68	25.52

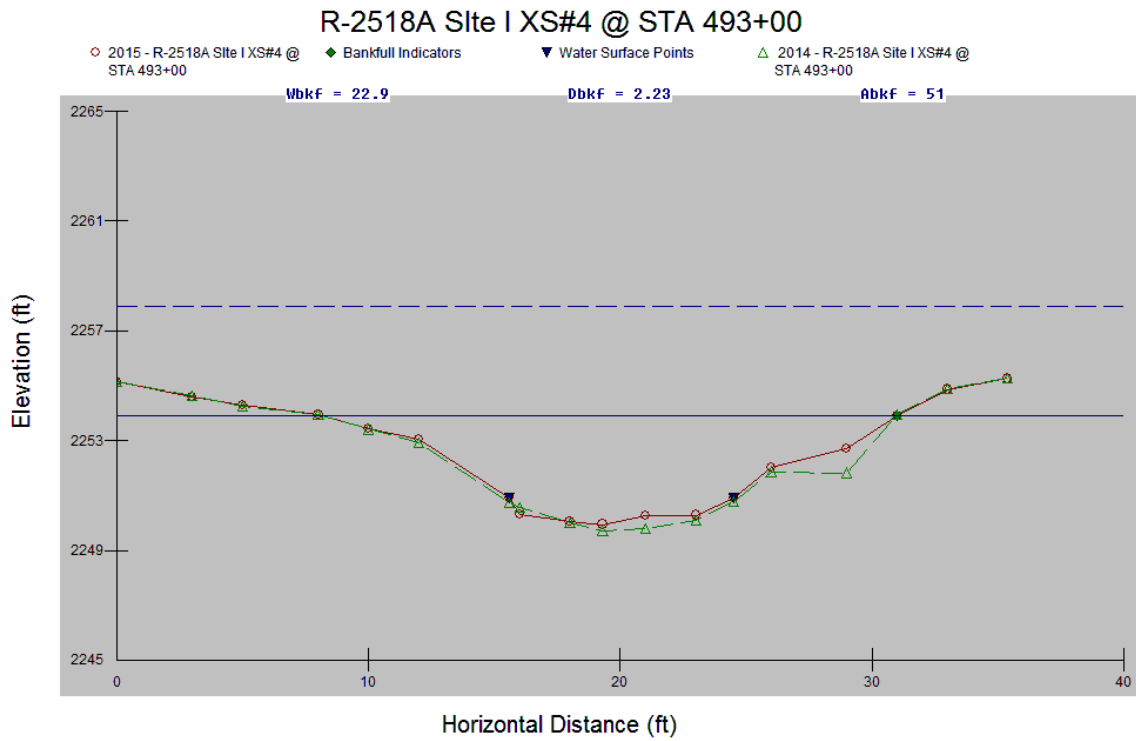
R-2518A Site I XS#3 @ STA 343+00



Site I: Cross-Section #3 (Pool) Abbreviated Morphological Summary						
	2010	2011	2012	2013	2014	2015
Bankfull Cross Sectional Area (ft ²)	60.29	65.99	64.06	56.03	56.73	56.09
Maximum Bankfull Depth (ft.)	4.35	4.7	4.47	4.22	4.06	3.39
Bankfull Mean Depth (ft.)	2.67	2.71	2.91	2.51	2.12	1.86
Bankfull Width (ft.)	22.59	24.38	22.03	22.36	26.77	30.09

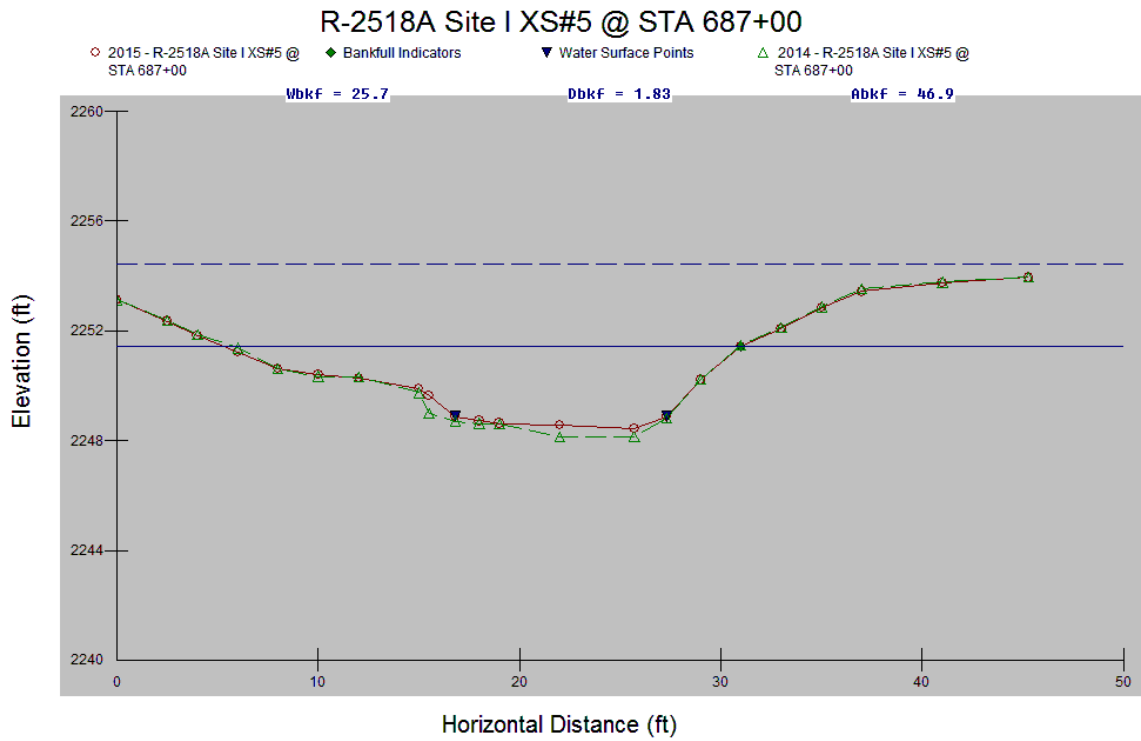
*According to the Rosgen Classification of Natural Rivers floodprone width, entrenchment ratio, and width depth ratio are not measured in pool, glide, or run features.

*Cross Section #3 had to be reset after stream repairs were completed in June 2014, so therefore, the 2014 and 2015 monitoring data was not overlaid with the previous monitoring years.



Site I: Cross-Section #4 (Riffle) Abbreviated Morphological Summary						
	2010	2011	2012	2013	2014	2015
Bankfull Cross Sectional Area (ft ²)	43.32	41.82	40.88	40.61	56.47	50.96
Maximum Bankfull Depth (ft.)	2.86	2.95	3.27	3.46	4.23	3.98
Width of the Floodprone Area (ft.)	35.4	35.4	35.4	35.4	35.4	35.4
Bankfull Mean Depth (ft.)	1.83	1.77	1.73	1.71	2.46	2.23
Width/Depth Ratio	12.9	13.35	13.62	13.89	9.35	10.26
Entrenchment Ratio	1.5	1.5	1.5	1.49	1.54	1.55
Bankfull Width (ft.)	23.61	23.63	23.57	23.75	23	22.88

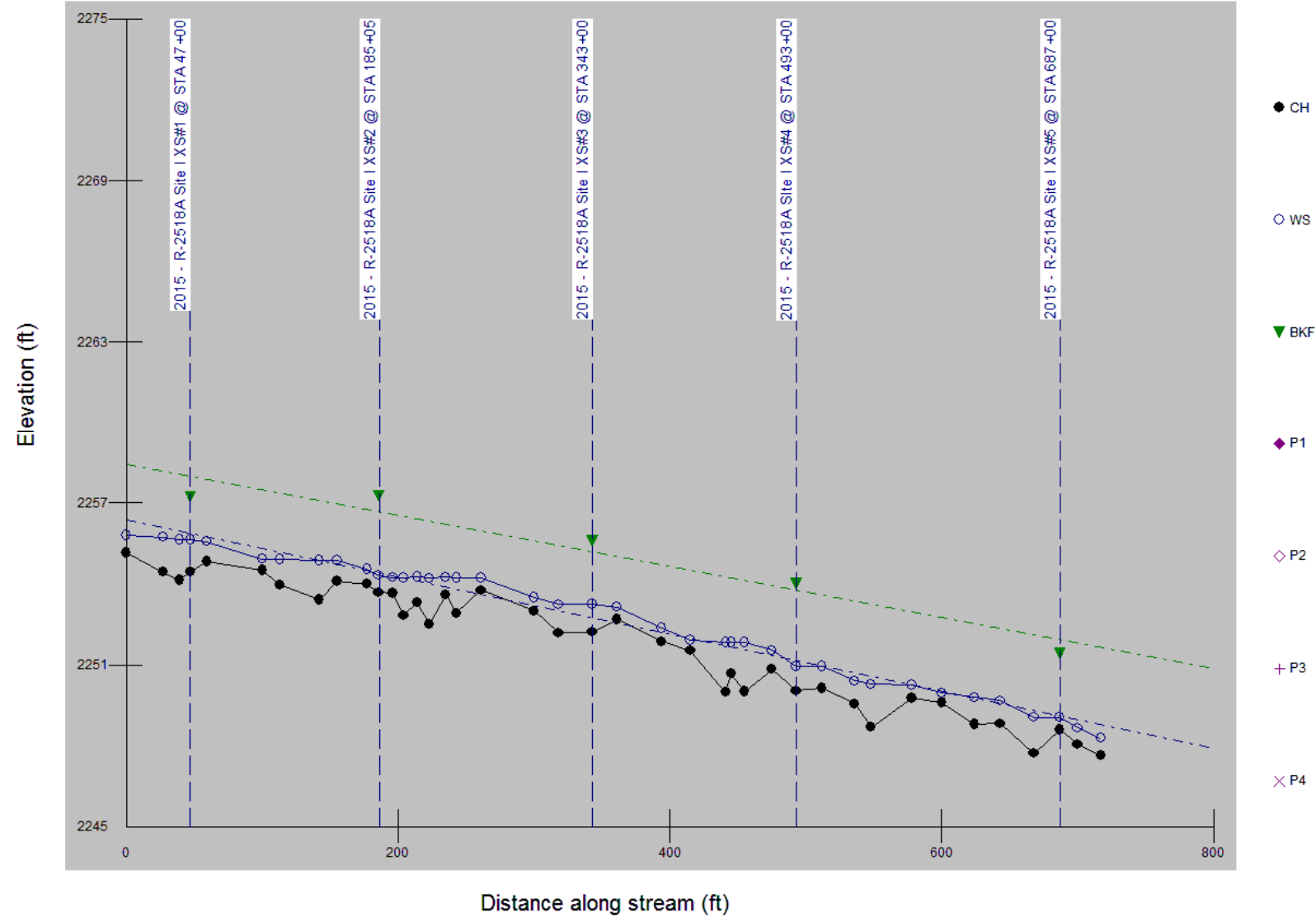
*Cross Section #4 had to be reset after stream repairs were completed in June 2014, so therefore, the 2014 and 2015 monitoring data was not overlaid with the previous monitoring years.



Site I: Cross-Section #5 (Riffle) Abbreviated Morphological Summary					
	2011	2012	2013	2014	2015
Bankfull Cross Sectional Area (ft ²)	52.26	46.77	49.35	51.08	46.92
Maximum Bankfull Depth (ft.)	2.89	2.78	2.99	3.33	3
Width of the Floodprone Area (ft.)	45.3	45.3	45.3	45.3	45.3
Bankfull Mean Depth (ft.)	2.04	1.87	1.96	2.01	1.83
Width/Depth Ratio	12.57	13.41	12.83	12.62	14.04
Entrenchment Ratio	1.77	1.81	1.8	1.79	1.76
Bankfull Width (ft.)	25.64	25.07	25.15	25.37	25.7

*Cross Section #5 had to be reset after stream repairs were completed in June 2014, so therefore, the 2014 and 2015 monitoring data was not overlaid with the previous monitoring years.

2015 - R-2518A Site I Profile



APPENDIX B
SITE PHOTOGRAPHS

Middle Fork Creek Site I



Photo Point #1 (Upstream)



Photo Point #1 (Downstream)



Photo Point #2 (Upstream)



Photo Point #2 (Downstream)



Photo Point #3 (Upstream)



Photo Point #3 (Downstream)

November 2015

Middle Fork Creek Site I



Photo Point #4 (Upstream)



Photo Point #4 (Downstream)



Photo Point #5 (Upstream)



Photo Point#5 (Downstream)

November 2015

Middle Fork Creek Site I



Vegetation Overview Photo



Vegetation Overview Photo

Middle Fork Creek Site I



Vegetation Overview Photo

July 2015